Nuytsia The journal of the Western Australian Herbarium

28: 147–158 Published online 12 April 2017

Acacia nicholsonensis (Fabaceae), a new 'Minni Ritchi'-barked species of *Acacia* sect. *Juliflorae* from the Gulf of Carpentaria region of Northern Australia

Nicholas J. Cuff[1] and Ian D. Cowie

Northern Territory Herbarium, Northern Territory Department of Land Resource Management, PO Box 496, Palmerston, Northern Territory 0830
[1]Corresponding author, email: nicholas.cuff@nt.gov.au

Abstract

Cuff, N.J. & Cowie, I.D. *Acacia nicholsonensis* (Fabaceae), a new 'Minni Ritchi'-barked species of *Acacia* sect. *Juliflorae* from the Gulf of Carpentaria region of Northern Australia. *Nuytsia* 28: 147–158 (2017). *Acacia nicholsonensis* Cuff is described as a new species of *Acacia* Mill. sect. *Juliflorae* (Benth.) Maiden & Betche. *Acacia nicholsonensis* is currently only known from the upper Nicholson River catchment in the far east of the Northern Territory where it is restricted to the levees and banks of major river channels. A key to the 'Minni Ritchi'-barked *Acacia* species of the Top End of the Northern Territory and adjacent regions of tropical northern Australia is presented. The conservation status and ecology of the new species are discussed.

Introduction

Patterns of diversity and endemism in the Northern Territory flora have been previously documented (Woinarski *et al.* 2006) with topographically and geologically diverse landscapes recognised as particular areas of significance. These patterns hold for Australia's largest vascular plant genus, *Acacia* Mill., with previous studies highlighting both the Arnhem Plateau and more broadly the rocky uplands of the Kimberley to Mt Isa tablelands as phytogeographically important for *Acacia* sections *Lycopodiifoliae* Pedley and *Juliflorae* (Benth.) Maiden & Betche (Hnatiuk & Maslin 1988; González-Orozco *et al.* 2011; Maslin & Cowie 2014). Indeed, northern Australia more generally is recognised as a centre of richness and diversity for sect. *Juliflorae* (Hnatiuk & Maslin 1988).

In this paper we describe a new species with distinctive 'Minni Ritchi' bark from the Gulf Fall and Uplands bioregion (Department of Environment 2013) in *Acacia* sect. *Juliflorae*, the largest section of the genus represented in the Northern Territory. 'Minni Ritchi' is a distinctive bark type usually found within, but not restricted to the genus *Acacia*, characterised by a pattern of exfoliation in which the outermost layers peel from the trunk in short, narrow strips, often from both ends, back upon themselves creating an appearance similar to planed timber (Brooker & Kleinig 1990; Maslin 1991, 2001).

The new species was first collected in 2010 in the far east of the Northern Territory in the upper reaches of the Nicholson River catchment, a diverse but relatively poorly surveyed area. The complex regional lithology and topographic diversity of the area have resulted in a varied range of landforms, which when superimposed with contemporary ecological processes (e.g. fire regimes) produces a complex mosaic

https://florabase.dpaw.wa.gov.au/nuytsia/
ISSN 2200-2790 (Online)
ISSN 0085-4417 (Print)

of habitat types operating at various spatial and temporal scales. This is a characteristic shared with other known areas of *Acacia* richness and diversity (Maslin *et al.* 2013). Intensive botanical survey has not been conducted within the area where the species was encountered since the 1970s, and the first collections of the new species were purely incidental to other survey work. This lack of systematic survey effort and the diversity of habitats suggest that there is reasonable likelihood further new taxa may be discovered in the region or the currently known geographic range of *A. nicholsonensis* Cuff will be extended. Indeed, recent publication of *A. citriodora* Kodela & Maslin includes new records of the species from the upper section of the South Nicholson River catchment (Kodela & Maslin 2015).

In this paper we provide a diagnostic key to other 'Minni Ritchi'-barked species known to occur within the Top End of the Northern Territory (north of 19° S; NT) and in adjoining regions of tropical Western Australia (WA) and Queensland (Qld).

Methods

This study was based primarily on morphological examination of field collections made by the first author as part of fire ecology projects in the Waanyi/Garawa Aboriginal Land Trust (ALT) between September 2010 and September 2011. Subsequent to its initial field collection in 2010, further opportunistic collection of specimens, and preliminary survey of the area to establish the distribution and abundance of the taxon, was undertaken in 2011 through to September 2015. Morphometric measurements were obtained from both fresh and dried materials now housed at DNA, MEL, NSW and PERTH.

Key to 'Minni Ritchi'-barked species of *Acacia* in tropical northern Australia

1. Phyllodes narrowly elliptic to orbicular or oblanceolate to obovate, 10–32 mm long, 5–15 mm wide; L:W ratio not exceeding 3; phyllode anastomoses numerous (widespread in WA, NT & western Qld) ..... **A. monticola**

1: Phyllodes not with above combination of characters; L:W ratio usually >>5; anastomoses generally absent to few (except in *A. helicophylla*)

2. Phyllodes distinctly spirally twisted (Top End of NT) ..... **A. helicophylla**

2: Phyllodes not spirally twisted

3. Phyllodes glabrous; seeds longitudinal (Kimberley region, WA) ..... **A. cyclocarpa**

3: Phyllodes variously puberulous to hairy, the hairs often restricted to between nerves or margins, or both (rarely glabrous in *A. lysiphloia*, if so then seeds always oblique); seeds longitudinal or oblique

4. Pod sericeous, villous or variously hairy especially when young

5. Pods distinctly curved to openly coiled (WA) ..... **A. trachycarpa**

5: Pods straight to slightly curved but never coiled

6. Pods +/- straight-sided with a dense, persistent, golden-brown, lanate indumentum; mature phyllodes generally >90 mm long (Gulf of Carpentaria, NT & possibly Qld) ..... **A. nicholsonensis**

6: Pod strongly sub-moniliform and villous, but lacking golden-brown, lanate indumentum; mature phyllodes shorter, <90 mm long (Kimberley region WA) ..... **A. minniritchi**

4: Pod glabrous

7. Pods resinous or viscid

8. Seeds oblique; pods straight to strongly curved (widespread) ..... **A. lysiphloia**

8: Seeds longitudinal; pods strongly curved into an open coil (Kimberley region, WA) ..... **A. cyclocarpa**

7: Pods not resinous or viscid

9. Seeds oblique (NT & Qld) ..... **A. chisholmii**

9: Seeds longitudinal (WA) ..... **A. delibrata**

Taxonomy

Acacia nicholsonensis Cuff, *sp. nov.*

Type: South Nicholson River crossing, Waanyi/Garawa Aboriginal Land Trust, Northern Territory, 29 September 2010, *N.J. Cuff* 019 *& D. Lynch* (*holo*: DNA D0221290; *iso*: PERTH 08595003).

Acacia sp. Nicholson River (N. Cuff & D. Lynch NT019-NC) Northern Territory Herbarium, in *Australia's Virtual Herbarium* http://avh.chah.org.au/ [accessed 5 July 2016] and *Flora NT* http://eflora.nt.gov.au/ [accessed 5 July 2016].

Obconic shrub or small tree 3–6 m tall, stems and major branches straight to crooked, ascending, with smaller lateral branches obliquely ascending to erect; crowns of mature trees rounded with sub-dense, grey-green foliage. *Bark* 'Minni Ritchi', red to red-brown, shedding in small strips to *c.* 40 mm in length and curling from both ends (particularly on younger branches), in multiple layers on trunk and major branches, becoming thinner on smaller branches. *Branchlets* red to red-brown with appressed white hairs when bark intact, becoming mottled with patchy red-brown bark shedding over smooth, yellow to light reddish brown bark when older, appearing somewhat fissured as bark splits, obscurely yellow-ribbed in distal portions but not obviously resinous. *New shoots* yellow-brown, angled or ribbed, with short, straight, white hairs 0.2–0.5 mm long. *Stipules* triangular to lanceolate, persistent, 0.8–2 mm long, thin-textured, brown with scattered, pale, straight hairs. *Youngest phyllodes* dull green to grey-green, compressed, narrowly transversely elliptic to sub-terete or flat in TS, generally not resinous, occasionally with sparse, brown-yellow resin encrusting nerves, pubescent, with short, straight, pale to golden hairs on and between raised, yellowish nerves. *Mature phyllodes* scattered, (85–)100–150(–185) mm long, 1.1–1.5 mm wide, flat, narrowly-linear to linear, straight to shallowly incurved or rarely shallowly sigmoid, ascending to erect, not rigid, singular at nodes, pale green to grey-green, with sparse to dense, short, appressed hairs between nerves and longer, isolated, ascending hairs on nerves and margins; *longitudinal nerves* (3–)5–8(–10), conspicuous, parallel, sub-distant, 0.08–0.12 mm apart, of generally uniform prominence but sometimes with 1 or 2 more prominent than the others, especially on younger phyllodes; anastomoses absent; sometimes resinous on young phyllodes but resin generally absent on mature phyllodes; *margins* not resinous (except in young phyllodes), with one edge consistently slightly thickened in comparison to the other; *apices* not pungently pointed but with a short, bent or slightly hooked, stiff (innocuous) apical point; *gland* inconspicuous, pore-like, situated on abaxial margin 0.5–3 mm above pulvinus. *Inflorescences* simple, singular within phyllode axils. *Peduncles* 3–9 mm long, with dense, appressed, yellow-gold hairs. *Basal peduncular bracts* single, caducous, 1–1.5 mm long, triangular with acute apex. *Spikes* cylindrical, 15–25 mm long, 2.5–5 mm wide when dry, golden. *Bracteoles* narrowly lanceolate, exserted in buds, generally persistent or tardily deciduous after anthesis, 1.2–1.8 mm long, 0.2–0.35 mm wide, golden brown with golden, straight to slightly curved hairs on margins and abaxial surface, becoming denser toward the base. *Flowers* 5-merous. *Calyx* 0.8–1 mm long, fused for approximately 2/3–3/4 of length, lobes prominently 5-nerved, the

lobes obtuse-triangular and fringed with +/- straight hairs. *Corolla c.* 1.4–1.7 mm long, dissected for less than 1/2 length, glabrous, golden yellow. *Ovary* shortly appressed-hairy throughout. *Stamens* numerous, at least double the number of calyx/corolla lobes. *Pods* 40–110 mm long, 2.4–4 mm wide, flat, straight to moderately curved or occasionally sigmoid, linear to narrowly oblong in outline, straight-sided to slightly constricted between the seeds, not prominently raised or inflated above seeds, coriaceous to sub-woody when mature, nerveless or nerves obscured by the indumentum, bright green when young, turning light brown, viscid (especially when young), indumentum dense, lanate, of golden brown hairs 0.8–1.1 mm in length on all surfaces, except consistently shorter (<0.5 mm) on the prominently thickened, non-resin encrusted, yellowish margins of the pod. *Seeds* longitudinal in pod, 3–4.5 mm long, ovoid to ellipsoid, shiny black to dark brown; *pleurogram* prominent, 0.1–0.17 mm wide, continuous, yellowish brown; *areole* oblong, raised, *c.* 0.7 mm long, 0.3 mm wide and similar in colour to rest of seed. *Aril* conspicuous, approximately 2/5 length of seed, sinuously 'folded' below seed, pale yellow to cream. (Figures 1, 2)

Diagnostic features. Multi- or single-stemmed *shrub* or small *tree* with 'Minni Ritchi' bark. *Mature phyllodes* scattered, ascending to erect, normally flat, mostly straight to shallowly incurved, linear to narrowly linear, (85–)100–150(–185) mm long, 1.1–1.5 mm wide, non-resinous, with short, appressed hairs between nerves and longer, ascending hairs on nerves and margins, narrowly transversely elliptic in TS, dull green, with apices terminated by a short, hard, innocuous point; *longitudinal nerves* conspicuous, usually 5–8. *Peduncles* appressed-hairy. *Sepal* lamina lobes fused for 2/3–3/4 of length, with a fringe of hairs. *Pods* linear, 2.4–4.4 mm wide, straight to moderately curved and resinous with dense, lanate indumentum of golden-brown hairs. *Seeds* longitudinal, 3–4.5 mm long, dark brown to black with yellowish brown pleurogram encircling raised areole, and a prominent, cream to yellowish aril.

Other specimens examined (in chronological order of collection). NORTHERN TERRITORY: Waanyi/Garawa Aboriginal Land Trust, South Nicholson River crossing, 8 Aug. 2012, *N.J. Cuff s.n. & D. Lynch* (MEL, NSW, PERTH); Waanyi/Garawa Aboriginal Land Trust, South Nicholson River crossing, 9 Aug. 2012, *N.J. Cuff s.n.* (DNA); Waanyi/Garawa Aboriginal Land Trust, South Nicholson River crossing, 14 Sep. 2014, *C.P. Yates s.n. & J.D. Evans* (DNA); Waanyi/Garawa Aboriginal Land Trust, *c.* 3 km upstream of the South Nicholson River crossing, 23 Sep. 2015, *N.J. Cuff* 318 (DNA); Waanyi/Garawa Aboriginal Land Trust, *c.* 5.3 km upstream of the South Nicholson River crossing, 23 Sep. 2015, *N.J. Cuff* 325 (DNA); Nicholson River Crossing on Nicholson River Road from Benmarra Station, 24 June 2016, *K. Brennan* 10639 (DNA); Darwin Botanic Gardens Nursery, Salonika Street, *B. Wirf* 1167 (DNA); Darwin Botanic Gardens, Salonika Street, *15-B000088* (cultivated from 14 Sep. 2014, *C.P. Yates s.n. & J.D. Evans*).

Phenology. The duration of flowering is uncertain but appears to encompass the mid- to late dry season (June–September) and overlap with fruiting. Specimens collected in September across a number of years have had both mature fruit and flowers on the same individual. Flowers at anthesis have also been collected in early August.

There are some indications flowering and fruiting may be related to the quality of the preceding wet season. Field survey in September 2015, following a below average wet season in the Gulf of Carpentaria (Bureau of Meteorology 2015), indicated that unlike previous years, little flowering had occurred and no fruit were evident on plants in the population.

Distribution and habitat. Known only from the Waanyi/Garawa ALT and the adjacent Benmarra Station in the Gulf Fall and Uplands Bioregion, where it occurs on the lower levees and banks of the

Figure 1. *Acacia nicholsonensis*. A – mature habit; B – trunk showing typical 'Minni Ritchi' bark; C – weakly resprouting individual. Photographs by K. van Wezel (A), N. Cuff (B) and G. Goldbergs (C).

upper reaches of the South Nicholson River (Figure 3). Field investigation suggests that the known global population (currently considered one sub-population) comprises a number of distinct patches along an approximately 7 km stretch of the South Nicholson River, where it appears to be restricted to finer red-brown loamy sands adjacent to the coarser river bed-load, and is the dominant mid-layer woody species.

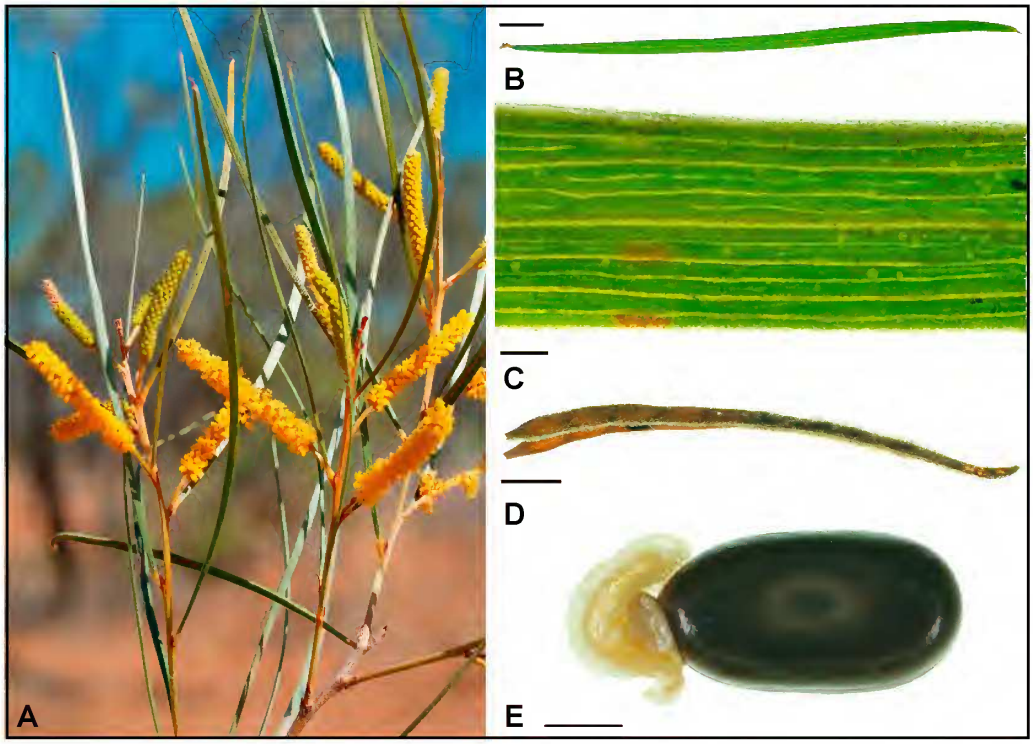

Figure 2. *Acacia nicholsonensis*. A – flowering branchlet; B – phyllode; C – phyllode detail; D – fruit; E – seed detail. Scale bars = 1 cm (B, D); 0.5 mm (C, E). Images from *Brennan* 10639 (A–C) and *N.J. Cuff* 318 (D, E). Photographs by K. Brennan.

Acacia nicholsonensis forms monotypic stands in association with *Eucalyptus camaldulensis* subsp. *obtusa* and *A. plectocarpa* subsp. *tanumbirinensis* in frontage open woodland. In unburnt areas the ground stratum is largely absent with sparse *Triodia pungens* hummocks prominent in more recently burnt parts of the population.

The geology of the area (known as the 'China Wall') is complex, with the river draining a range of igneous, variously metamorphosed sedimentary and deeply weathered Tertiary lithologies including the Buklara Sandstone, Nicholson Granite and Murphy Metamorphics (Roberts *et al.* 1972). Field survey of an approximately 10 km stretch of the river corridor around the type locality revealed a number of patches upstream of the South Nicholson River crossing, with the soil and regolith appearing to show a strong influence from the immediately adjacent Nicholson Granites. Conversely, the species was largely absent from accessible downstream sections of the riparian corridor as the soils transitioned into the heavier-textured loams derived from the Murphy Metamorphics and finer-grained sedimentary rocks of the Mullera Formation.

Survey of smaller alluvial systems draining the China Wall to the east of the type locality has so far failed to locate additional sub-populations of *A. nicholsonensis* in similar habitats. Further survey in the area is considered moderately likely to locate additional sub-populations upstream of the type locality. However, survey indicates that despite apparently suitable habitat being present downstream, the species is absent. Extensive surveys in North West Queensland have also failed to detect the species within downstream sections of the Nicholson River system (D. Kelman (BRI) pers. comm.).

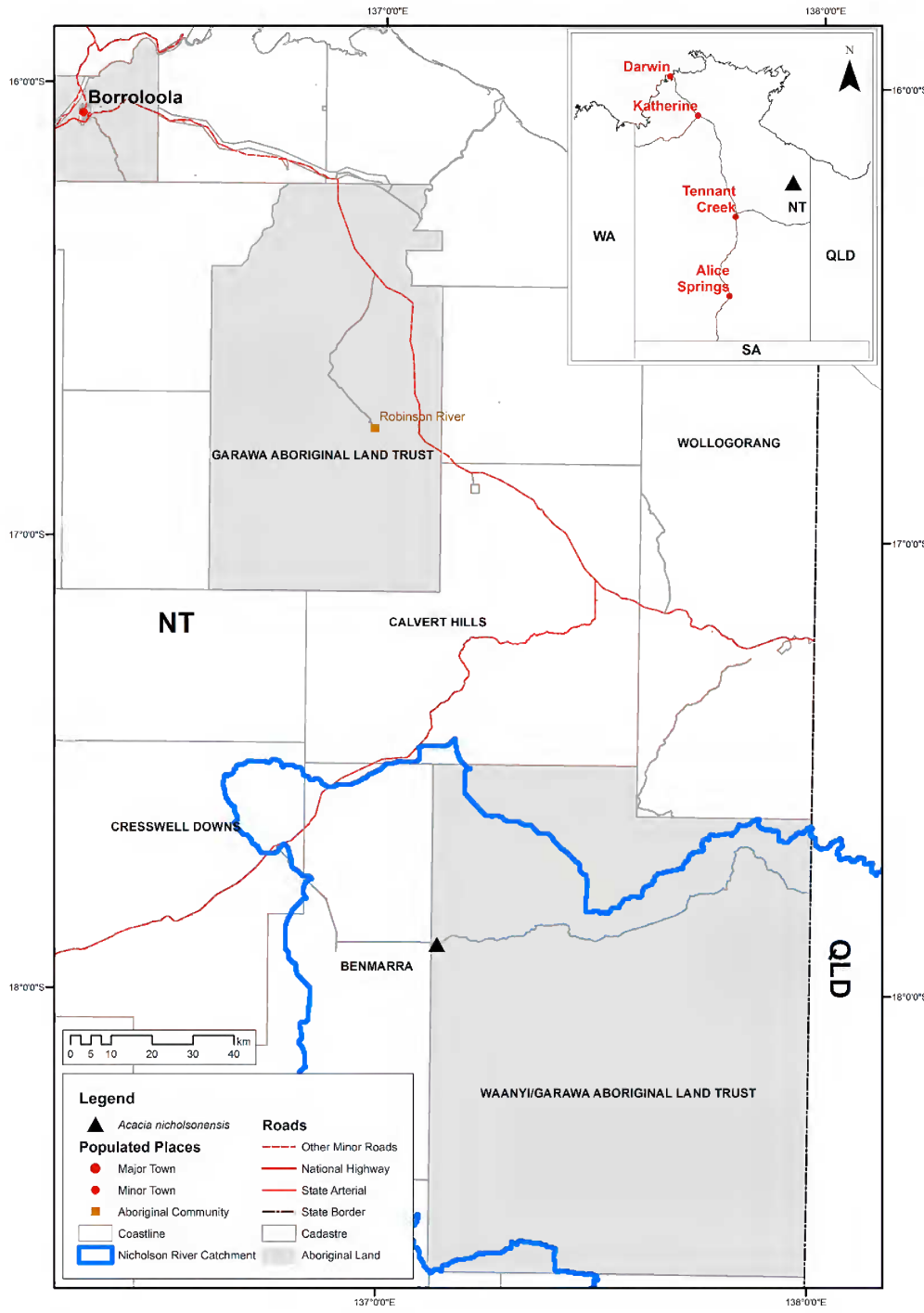

Figure 3. Distribution of *Acacia nicholsonensis* in the Northern Territory of Australia. Map grid:1 degree increments of the Geocentric Datum of Australia (GDA94). Cadastral, road and populated place data supplied courtesy of Northern Territory Government; river catchment and topographic framework data courtesy of GeoScience Australia.

Ecology and conservation status. As with other poorly known *Acacia* species in the Northern Territory (e.g. Maslin & Cowie 2014), further research is required to better establish the population status, basic life-history parameters, longevity of seed, and the role that fire and other ecological processes play in the distribution and abundance of the species.

The known patches are highly likely to be genetically connected and are regarded as a single sub-population following the IUCN definition (IUCN Standards and Petition Subcommittee 2014) with field data estimates indicating the known global population is likely to be less than 12,500 mature individuals (as calculated from density estimates within patches).

Density of individuals and demographic structure of patches is thought to vary considerably, particularly in relation to recent fire history. Mature patches to the east and south of the Nicholson River crossing appear to occupy long-unburnt (>8 years) areas protected from fire by both the mesic riparian corridor and a constructed firebreak on the Waanyi/Garawa lands. Mature stands appear even-aged, comprised of individuals averaging 3–5 m in height and with a diameter at breast height (DBH) of 6–12 cm, forming dense (>1,000 stems/hectare) stands (Figure 4A) with a high ratio of mature to juvenile plants (<100 juveniles/hectare). A small proportion of mature individuals appear to exhibit some capacity to resprout basally after disturbance (low to moderate intensity fire; Figure 1C) although the vast majority appear particularly sensitive to wildfire.

Conversely, recently burnt (2012) patches on the western side of the South Nicholson River are characterised by high densities (>3,000 stems/hectare) of single-stemmed juvenile plants (0.1–1.5 cm DBH) with standing-dead mature plants readily identifiable at similar densities to those observed in unburnt patches. The high seedling/juvenile:adult ratios in these recently burnt areas and the growth form of juvenile plants with high shoot:root ratios suggests that the majority of regeneration is from soil-stored seed (Pate *et al.* 1990; Vaughton 1998; Figure 4B). The even-aged structure of mature stands further reinforces that the current demographics reflect periods of episodic mass recruitment from a seed bank following an external trigger, in this case likely to be fire. This response and population structure is similar to the regenerative response observed in many other obligate seeding tree and shrub species in fire-prone environments (e.g. Vaughton 1998; Pickup *et al.* 2003; Russell-Smith 2006; Barrett & Cochrane 2007).

The conservation status of the species has not previously been assessed against the IUCN criteria (IUCN 2012; IUCN Standards and Petition Subcommittee 2014). Initial estimates of the extent of occurrence, area of occupancy and the number of locations of *A. nicholsonensis* are within the range of the threatened categories outlined in the IUCN criteria (IUCN 2012; IUCN Standards and Petitions Subcommittee 2014) but are somewhat uncertain, given the lack of exhaustive survey within suitable habitats in the area and need for further evaluation of threats. The species should at this stage be listed as Data Deficient. The species is likely to be worthy of future listing following more exhaustive field survey of the global-population and evaluation of threats. However, given the limited number of collections, single geographic locality from which it is known and high probability that it has a relatively limited range, a 'Restricted Range' status appears appropriate in the Northern Territory.

The species appears vulnerable to unfavourable fire regimes, which have the potential to result in substantial population reductions within short time frames. Frequent, intense, late-dry season fires are known to have the potential to cause significant and rapid fluctuations in the abundance of woody shrub species in the Top End, particularly obligate seeding species (Russell-Smith *et al.* 1998; Russell-Smith *et al.* 2002; Russell-Smith 2006). This could be considered a significant threatening process for the global population and contribute to a future conservation listing under the IUCN Guidelines.

Figure 4. *Acacia nicholsonensis*. A – stand structure in long unburnt habitat; B – seedling regeneration in recently burnt habitat. Photographs by N. Cuff.

At the same time, local scale topographic barriers provide an element of fire protection, reducing the probability that the global population would be catastrophically affected by a single fire.

Etymology. The epithet is derived from the geographic locality of the type collection on the South Nicholson River, a drainage system to which the species appears to be restricted.

Affinities. The affinities of *A. nicholsonensis* to other members of sect. *Juliflorae* are currently unclear and largely speculative. *Acacia cyperophylla* F.Muell. ex Benth. is of a similar habit and occupies a similar habitat (along watercourses) to *A. nicholsonensis* in arid regions of Australia, although it is not currently known to occur north of *c.* 20° South (Wauchope) in the Northern Territory. *Acacia nicholsonensis* is possibly allied to *A. cyperophylla* given the similar combinations of 'Minni Ritchi' bark, inflorescence type, calyx lobe fusion and seed orientation characters. However, in most cases *A. cyperophylla* is readily separated from *A. nicholsonensis* by its glabrous, terete (although occasionally flat) phyllodes and its usual absence of a prominent indumentum on most surfaces.

Superficially, *A. nicholsonensis* appears similar to *A. fauntleroyi* (Maiden) Maiden & Blakely and *A. oncinophylla* Lindl., both of which are endemic to the south-west of Western Australia. The significant characters shared by these species include the densely lanate, resinous pods, long, linear, non-pungent phyllodes with short appressed hairs and slightly asymmetrically thickened margins, as well as the sepals and petals each united (connate) for >1/2 to 2/3 of their respective lengths. *Acacia nicholsonensis* and *A. fauntleroyi* also both have characteristically longer hairs on the phyllode nerves and margins. Despite these similarities, the very wide geographic separation would suggest that the actual phylogenetic relationships of *A. nicholsonensis* are unlikely to be close to these two species.

A number of features of *A. nicholsonensis* appear to be shared with *A. lysiphloia* F.Muell. with which it co-occurs along the Nicholson River, including 'Minni Ritchi' bark, persistent, triangular stipules, long, dense cylindrical spikes with long peduncles, and viscid pods with margins thickened on at least one side. This latter species is noted to readily intergrade with other *Acacia* species including *A. monticola* J.M.Black (Tindale *et al.* 2001a). Superficially, the gross morphology of *A. plectocarpa* subsp. *tanumbirinensis*, which is the most common co-occurring *Acacia* species in the habitat of the new species, is also similar to *A. nicholsonensis*. 'Minni Ritchi'-barked species are also known to hybridise with non-'Minni Ritchi'-barked species in the Pilbara (e.g. *A. trachycarpa* × *tumida* var. *pilbarensis*) and Kimberley (e.g. *A. eriopoda* × *monticola*, *A. eriopoda* × *trachycarpa*) regions of Western Australia (Tindale *et al.* 2001b).

It is conceivable that the new species may be a hybrid between *A. lysiphloia* and *A. plectocarpa* subsp. *tanumbirinensis*, although neither of these potential parent species possesses the combination of calyx or pod indumentum and seed orientation characters seen in *A. nicholsonensis*. Nursery growth trials with seed of the new species indicates that seedlings retain the morphological characters unique to the wild plants and do not exhibit characteristics beyond those superficial resemblances already mentioned to the possible parent taxa. It is hoped that future molecular studies will assist in fully resolving the affinities of the new species to other members of the section.

Acknowledgements

Traditional owners of the Waanyi/Garawa ALT for allowing access and in particular Jimmy Morrison and Jack Green (Northern Land Council - Booroloola) for helping to facilitate field work on the ALT. Peter Brocklehurst, Jason Hill and Alaric Fisher (NT Department of Land Resource Management) for facilitating and supporting the opportunity for NJC to partake in field survey on the ALT. Dominique Lynch and the Darwin Centre for Bushfires Research for providing the opportunity to make the initial collection of *A. nicholsonensis*. Cameron Yates, Jay Evans and Andrew Edwards (Darwin Centre for Bushfires Research) and Mark Desailly (Bushfires NT), for collecting additional material subsequent to the initial collection in 2012 and 2014. Jay Evans, Jeremy Russell-Smith (Darwin Centre for Bushfire Research), Kamaljit Sangha, Rowan Fisher and Grigorijis Goldbergs (Charles Darwin University) for field assistance in surveying the extent and density of the species. Bruce Maslin for providing the

impetus for the preparation of this manuscript. Peter Jobson (NT), Donna Lewis and Deb Bisa (DNA) for providing guidance, comment and edits that greatly improved the manuscript. Dan Kelman, Ron Booth and John Thompson (BRI) for useful discussion regarding the flora of the Gulf Fall and Uplands and the possible extent of *A. nicholsonensis* in the region. Kate van Wezel and Grigorijis Goldbergs for contributing photographs in Figure 1, and Kym Brennan for contributing the photographs used in Figure 2. Ben Wirf from the George Brown Botanic Garden, Darwin for germinating and growing on seed collected from the type locality. Jo Palmer, the Director and staff of CANB are thanked for a making a first-timer welcome and allowing access to the collection!

References

Barrett, S. & Cochrane, A. (2007). Population demography and seed bank dynamics of the threatened obligate seeding shrub *Grevillea maxwellii* McGill (Proteaceae). *Journal of the Royal Society of Western Australia* 90: 165–174.

Brooker, M.I.H. & Kleinig, D.A. (1990). *Field guide to eucalypts. Volume 2: South-western and Southern Australia.* (Inkata Press: Melbourne.)

Bureau of Meteorology (2015). *Monthly Rainfall Benmara (14720).* Australian Government http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=014720 [accessed 6 October 2015]

Department of the Environment (2013). *Australia's bioregions (IBRA)*, IBRA7, Commonwealth of Australia. http://www.environment.gov.au/land/nrs/science/ibra#ibra [accessed 2 January 2014].

González-Orozco, C.E., Laffan, S.W. & Miller, J.T. (2011). Spatial distribution of species richness and endemism of the genus *Acacia* in Australia. *Australian Journal of Botany* 59: 601–609.

Hnatiuk, R.J. & Maslin, B.R. (1988). Phytogeography of *Acacia* in Australia in relation to climate and species richness. *Australian Journal of Botany* 36: 361–383.

IUCN (2012). *IUCN Red List categories and criteria.* Version 3.1 Second Edition. Gland, Switzerland and Cambridge, UK. 32 pp. http://jr.iucnredlist.org/documents/redlist_cats_crit_en.pdf

IUCN Standards and Petitions Subcommittee (2014). *Guidelines for using the IUCN Red List categories and criteria.* Version 11. Prepared by the Standards and Petitions Subcommittee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf

Kodela, P.G. & Maslin, B.R. (2016). *Acacia citriodora* (Fabaceae: Mimosoideae), a new species from northern Australia. *Nuytsia* 27: 99–102.

Maslin, B.R. (1991). *Acacia cyperophylla* var. *omearana*, a new variety of "Minni Ritchi" Acacia from the Pilbara region of Western Australia. *The Western Australian Naturalist* 18: 184–188.

Maslin, B.R. (2001). Mimosaceae, *Acacia* Part 2. *In*: Orchard, A.E. & Wilson, A.J.G. (eds) *Flora of Australia* Vol. 11B. (Australian Biological Resources Study: Canberra.)

Maslin, B.R., Barrett, M.D. & Barrett, R.L. (2013). A baker's dozen of new wattles highlights significant *Acacia* (Fabaceae: Mimosoideae) diversity and endemism in the north-wet Kimberly region of Western Australia. *Nuytsia* 23: 543–587.

Maslin, B.R. & Cowie, I.D. (2014). *Acacia equisetifolia*, a rare, new species of *Acacia* sect. *Lycopodiifoliae* (Fabaceae: Mimosoideae) from the Top End of the Northern Territory. *Nuytsia* 24: 1–5.

Pate, J.S., Froend, R.H., Bowen, B.J., Hansen, A. & Kuo, J. (1990). Seedling growth and storage characteristics of seeder and resprouter species of Mediterranean-type ecosystems of S.W. Australia. *Annals of Botany* 65: 585–601.

Pickup, M., McDougall, K.L. & Whelan, R.J. (2003). Fire and flood: Soil stored seed bank and germination ecology in the endangered Carrington Falls Grevillea (*Grevillea rivularis*, Proteaceae). *Austral Ecology* 28: 128–136.

Roberts, H.G., Rhodes, J.H. & Yates, K.R. (1972). *1:250 000 Geological Series – Explanatory Notes. Calvert Hills Northern Territory Sheet SE/53-8 International Index.* (Australian Government Publishing Service: Canberra.)

Russell-Smith, J., Ryan, P.G., Klessa, D., Waight, G. & Harwood, R. (1998). Fire regimes, fire-sensitive vegetation and fire management of the sandstone Arnhem Plateau, monsoonal northern Australia. *Journal of Applied Ecology* 35: 829–846.

Russell-Smith, J., Ryan, P.G. & Cheal, D.C. (2002). Fire regimes and the conservation of sandstone heath in monsoonal northern Australia: frequency, interval, patchiness. *Biological Conservation* 104: 91–107.

Russell-Smith, J. (2006). Recruitment dynamics of the long-lived obligate seeders *Callitris intratropica* (Cupressaceae) and *Petraeomyrtus punicea* (Myrtaceae). *Australian Journal of Botany* 54: 479–485.

Tindale, M.D., Kodela, P.G., Bedward, M., Davies, S.J., Herscovitch, C., Keith, D. & Morrison, D.A. (2001a). *Acacia lysiphloia. In*: Orchard, A.E. & Wilson, A.J.G. (eds) *Flora of Australia* Vol. 11B. p. 209. (Australian Biological Resources Study: Canberra.)

Tindale, M.D., Kodela, P.G., Bedward, M., Davies, S.J., Herscovitch, C., Keith, D. & Morrison, D.A. (2001b). *Acacia eriopoda. In*: Orchard, A.E. & Wilson, A.J.G. (eds) *Flora of Australia* Vol. 11B. p. 190. (Australian Biological Resources Study: Canberra.)

Vaughton, G. (1998). Soil seed bank dynamics in the rare obligate seeding shrub, *Grevillea barklyana* (Proteaceae). *Austral Ecology* 23: 375–384.

Woinarski, J.C.Z., Hempel, C., Cowie, I., Brennan, K., Kerrigan, R., Leach, G. & Russell-Smith, J. (2006). Distributional patterns of plant species endemic to the Northern Territory, Australia. *Australian Journal of Botany* 54(7): 627–640.